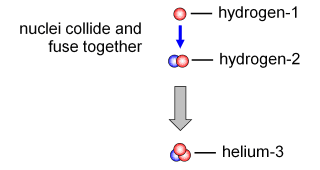
Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_\_

Chapter \_\_\_\_\_\_\_\_\_\_ Section \_\_\_\_\_\_\_\_ pages \_\_\_\_\_\_\_\_\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Life and Death of Stars**

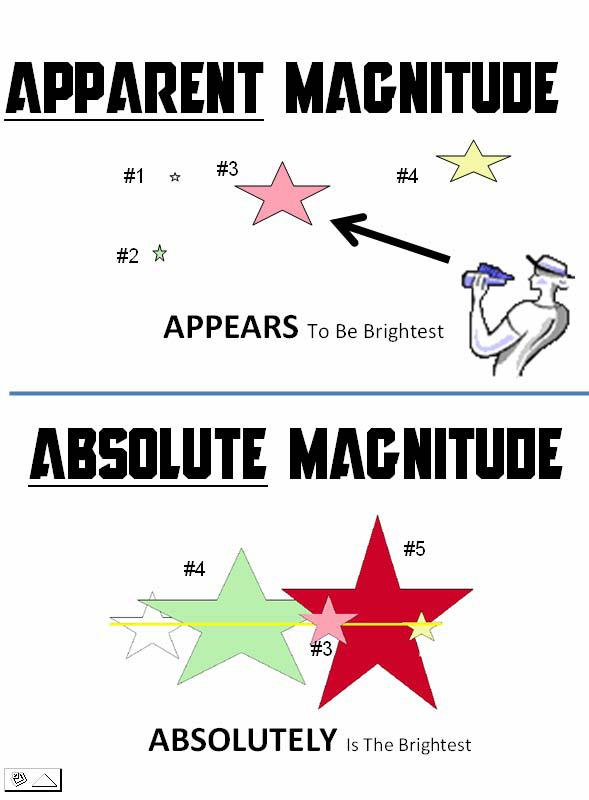
**Stars** are: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Formed from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and go through different stages as they age.
* Located different distances from Earth
  + Light-year: \_\_\_\_\_\_\_\_\_\_\_ light travels in 1 year (9.5 x 1012m)
    - Light from Sun takes 8 minutes to reach Earth!

**How do stars get their energy?**

* Nuclear fusion:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - each time two particles \_\_\_\_\_\_\_\_\_\_\_\_\_\_🡪\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Star Anatomy**

* Energy moves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ through layers of star through two processes:
  + Convection: similar to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in layers of Earth; hot gas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Radiation: energy is transferred to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪atoms absorb energy and keep on transferring to other atoms randomly
* Interior of star: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (only nuclei and electrons)

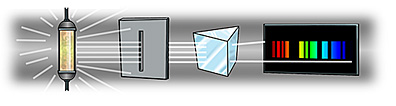
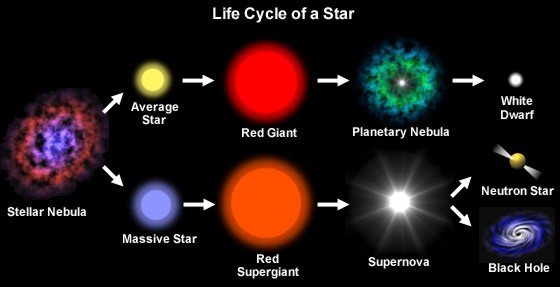
**Apparent vs. Absolute Brightness**

* Brightness of a star depends on:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Apparent** brightness: brightness of a star \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Absolute** brightness: how bright a star \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

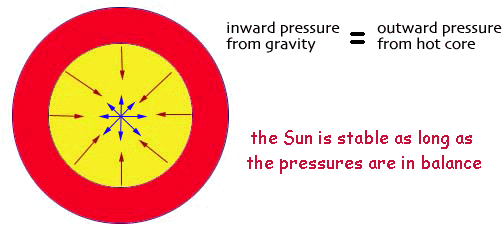
**What does the color of a star mean?**

* Star’s \_\_\_\_\_\_\_\_\_\_\_ wavelength corresponds to a color (λ with most energy)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ determines \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which determines \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ objects🡪 \_\_\_\_\_\_\_\_\_ intensity🡪\_\_\_\_\_\_\_\_\_\_\_\_\_ wavelength= RED
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ objects🡪 \_\_\_\_\_\_\_\_\_ intensity🡪\_\_\_\_\_\_\_\_\_\_\_\_\_ wavelength= BLUE

**What elements make up stars?**

* Almost all stars are made up of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Emission spectra:
  + Burning gas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Each wavelength corresponds to a different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Scientists match \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ up with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to determine the elemental composition of stars.

**Star Life Cycle** *(refer to Star Life Cycle worksheet)*

* **Stellar Nebula**
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of stars🡪cloud of dust and gas
  + Nuclear fusion occurs and a star is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!
* **Sun**
  + \_\_\_\_\_\_\_\_\_\_\_\_ within Sun generates energy that produces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on Sun
    - Opposing forces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and keep Sun at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ size.
  + Sun will die when fusion reactions \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* **Main Sequence/Average or Massive Star**
  + Star continues process of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of life cycle (~100,000 years)
  + Star grows and becomes stable during this stage
    - \_\_\_\_\_\_\_\_\_ % of stars in galaxy are at this stage (including our Sun) & stay here for most of their lives.
  + Massive stars evolve much \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than average stars.
* **Red Giant/Red Super Giant**
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_ star with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ surface.
  + Formed during \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of star’s life.
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fuel begins to run out🡪 less fusion occurring
  + Star \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in size.
  + Temperatures cool as expansion occurs🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ color
* **Death of a *Low* Mass Star**
  + Planetary Nebula
    - gas is used up🡪 star condenses and outer atmosphere blows off
  + White Dwarf (*as dense as Sun but as big as Earth*)
    - last of remaining \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - Core of heavy elements \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - No longer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 slowly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
      * Most stars in our galaxy will end as white dwarfs.
* **Death of a *High* Mass Star**
  + Supernova
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which triggers a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a Red Super Giant star
    - this collapse triggers a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Final fate of high mass star death is determined by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the star.
    - 1.4 to 3 solar masses forms a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ *OR*
    - Greater than 3 solar masses forms a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      * Neutron Star:
        + Very small and \_\_\_\_\_\_\_\_\_\_\_\_ and composed of mainly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
      * Black Hole:
        + Collapse is so great that all matter (even light) is pulled in due to gravitational force.
        + Can be detected by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**H-R Diagram**

* A way of classifying stars based on:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 hottest (\_\_\_\_\_\_\_\_\_\_\_) 🡪 coolest (\_\_\_\_\_\_\_\_\_\_\_\_\_) [ \_\_\_\_\_ -axis]
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 in comparison to our Sun (1) [ \_\_\_\_\_\_\_\_ -axis]
  + 90% of stars occupy the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and change position on graph as they age.